Micro- and nanotexturization of Liquid Silicone Rubber (LSR) surfaces by injection moulding

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Micro and nanotexturization of polymeric surfaces can provide different promising functionalities and materials with potential applications in markets so different as the medical and automotive. Nature is a source of inspiration, a wide variety of surface with hierarchical structures at micro- and nanoscale can be found: lotus and taro leaves, gecko feet, butterfly wings or fish skin are some examples. These surface topographies possess wetting properties that are of commercial interest such as superhydrophobicity, self-cleaning, drag reduction or antireflection [1].
In the present work the material chosen is a Liquid Silicone Rubber (LSR): a two-component silicone (the base and the activator) with good elastic properties, extreme temperature resistance and low compression set. The replication of textures was carried out by the injection moulding process, due to his high productivity. The process starts with the fixation of the texturized film in the mould and its overmoulding. At the end, a texturized piece is obtained while the printed film remains on the mould. The parameters optimization of the injection moulding allows increasing the replication grade.
The LSR injection process consists in maintain the two-component mixture cold before pushing it on the heat mould, where temperature favours vulcanization. The use of polymeric texturized films obtained by nanoimprint lithography as an alternative to texturized moulds presents a heat insulating capability, which delays the silicone vulcanization and allows a complete filling of nanostructures [2]. Moreover, the low viscosity attained during processing of LSR (with respect other thermoplastic melts) makes it a good candidate for surface replication.
Therefore, Figure 1 shows a good replication grade of LSR surfaces with different geometries obtained during this work. Also, hydrophobic behaviour can be measured due to the change in the contact angle.

References

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[2] John M. Stormonth-Darling, Nikolaj Gadegaard, Macromol. Mater. Eng. (2012), 297, 1075–1080

Figures

A) B)

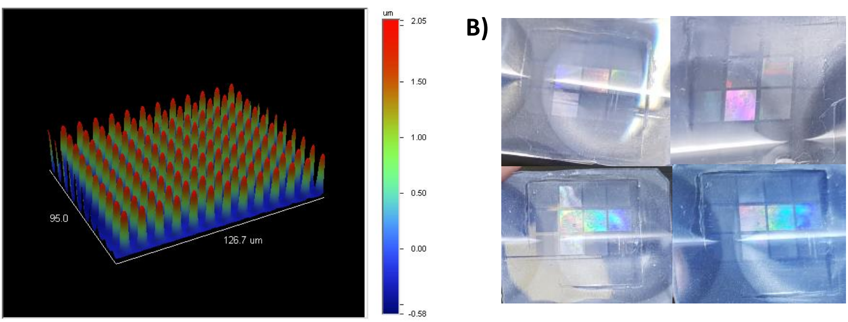

Figure 1: A) Interferometric microscopy images of LSR texturized surfaces: Pillars of 5 µm diameter and 2.5 µm height. B) Texturized surface of selected LSR pieces.